Operations and Engineering Division Report

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Organization and Mission

The largest of the NSLS Divisions, Operations and Engineering consists of three sections: Operations, which is led by Richard Heese, Electrical Systems, led by Richard Biscardi, and Mechanical Engineering, led by Ed Haas. The mission of our division falls into three main areas:

- Operation of the NSLS 24 hours a day, 7 days a week, an average of 44 weeks a year.
- Design, fabrication, and maintenance of the NSLS accelerators and utilities, including upgrades and modifications to meet changing needs.
- Engineering and technical support for the other NSLS divisions and the NSLS user community.

As the department continues to emphasize beamline operations, we are increasingly relying upon a department-wide matrixed management approach: The Operations and Engineering Division (OED) draws resources from other divisions to support operations, and we provide special expertise to support development for other divisions.

2003 Activities This report provides a transition to reporting activities by the calendar year. Hence, three major shutdowns are included as well as operations throughout the year. Operational performance statistics will continue to be reported on a fiscal year basis. An overview of machine performance for Fiscal Year 2003 is provided in section 6, 'Facility Facts and Figures.'

X29: A series of major installation tasks spanning several shutdowns revolved around the development of an insertion device based program at beamline X29. A new ring vacuum chamber for an insertion device beamline had previously been installed in the x-ray ring. During December 2002, our third new RF cavity was installed in the X29 straight section. With this installation, two new cavities reside in the straight, providing space for the installation of a Mini Gap Undulator (MGU), identical to that already in service at X13. Shield wall modifications were also made during the December 2002 shutdown that allowed construction of the beamline on the floor to commence.

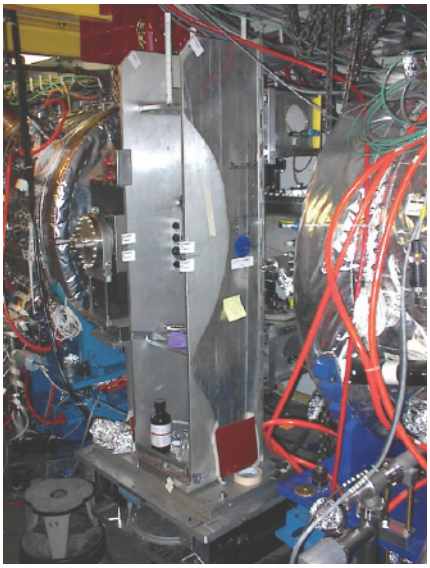
During the May 2003 shutdown, the MGU itself was moved into place between the RF cavities. The installation of the MGU controls, active interlock electronics, and beamline front-end was completed in the December 2003 shutdown, with commissioning starting in January of 2004. The X29 MGU project exercised the 'matrix organization' concept to the fullest, as its success depended upon significant contributions from every NSLS division and the collaboration building the beamline. While X29 was a major activity for the OED, it is an achievement for the entire NSLS.

NSLS-II: A major initiative for the NSLS community, NSLS-II has been a high priority for the department throughout the year. The OED has contributed primarily through the development of engineering

conceptual designs, project schedules, and cost estimates to meet the requirements established by the User Science and Accelerator Divisions.

Surprises and Triage: Nearly every parameter of the NSLS has been expanded beyond its original design goals. Careful evaluation of changes as well as diligent maintenance of the machines has allowed our user community to enjoy a very high degree of reliability. However, as the machine ages, problems do crop up, and 2003 seemed to be a bumper year for surprises.

On the X-ray ring, the increase in operating energy to 2.8 GeV and the implementation of the high brightness optical configuration required the current of the defocusing string of sextupole magnets to be raised from 500 amperes to over 800 amps. This almost tripled the power dissipated in the magnet string. The change was carefully evaluated before it was instituted several years ago, but it was known that the magnets would become more sensitive to flow disruptions. Coming out of the December 2003 shutdown, we experienced a failure of a coil in one of the magnets in the string. This particular magnet is buried within the LEGS area of the machine, making it both a 'one of a kind' and very difficult to access. Removing and repairing the magnet took nearly two weeks, cutting significantly into January 2003 operations. Later in the year, another magnet in the same string started overheating, although it did not fail. In the December 2003 shutdown, during preparations to replace the magnet, a blockage was discovered (and removed) from the magnet buss work, alleviating the overheating.



The new MGU between the RF cavities in the X29 straight section.

Various vacuum problems also contributed to operational headaches in 2003. In the month running up to the May 2003 shutdown, a small leak developed in a stripline monitor in the X-ray ring, causing a reduced beam lifetime, which led us to start the shutdown two days early. The leak was successfully repaired during the shutdown. During the summer, we also had a user vacuum venting accident and a leak in an ion pump feedthrough. It failed when it was sprayed by a fine mist of water from a pinhole leak in the body of a brass fitting four feet away that had been in place for over 15 years!

This also happened to be the year of the Northeast black out in August, causing nearly three days of X-ray operations downtime. This year the 'unusual' problems on the X-ray ring accounted for more than 12 days of down time, with just over six days due to the more typical operations problems. Overall, for fiscal year 2003, machine reliability was 89% for X-ray, although UV reliability remained high at 98%.

These very visible events tend to overshadow the failures that didn't happen because of the vigilance of the staff that maintains and repairs the machines out of the sight of the user community. Examples include the repair of the U14 water cooled mask during the May 2003 shutdown, the U4IR mirror rebuild during the December 2003 shutdown, and the upgrade of the X17 wiggler controls in December 2003. Magnet power systems, injection control, and diagnostic systems were also upgraded without fanfare; these are all systems that are essential to maintaining the performance and reliability of the NSLS. As we look forward to NSLS-II, the staff of the OED is prepared to meet the challenge of keeping the current NSLS performing at its best for another decade.